GARDENS AND FOREST DEPARTMENT,

STRAITS SETTLEMENTS.

AGRICULTURAL BULLETIN

OF THE

MALAY PENINSULA.

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It is proposed to publish from time to time, as occasion may serve, Bulletins on subjects connected with Agriculture and Horticulture in the Malay Peninsula. It is hoped that planters will send to the Director of the Botanic Gardens, Singapore, notes and observations on the cultivations of the various crops under their care. Observations on insect and fungus-pests are especially requested, and these should always be accompanied by specimens of the injurious insect or fungi either alive, or preserved in spirits, except in the case of butterflies and moths, which should be sent dry in envelopes.

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DYE PLANTS.

The introduction of the Aniline dyes has here as in other parts of the world caused the use of such dye plants as we possess in the Malay Peninsula to be almost abandoned. Indigo and Samak are the only vegetable dyes now used to any large extent.

The following is a list of the Native or cultivated dye-plants of the Peninsula as known to me :—

Indigofera tinctoria, L. produces Indigo.
Marsdenia tinctoria, Br. "Tarom Akar." Indigo.
Fibraurea chloroleuca, Miers "Akar Kunyit." Yellow dye.
Peltophorum ferrugineum, Benth "Batai." Yellow dye.
Peristrophe tinctoria, Nees "Noja." Pink.
Lawsonia alba, L. "Inai." Red.
Cesalpinia sappan, L. "Sepang." Red.
Morinda tinctoria, L. "Mengkudu." Brown.
Eugenia lepidocarpa, Wall. "Samak." Brown.
Several *Rhizophoraceæ*. Brown.
Dæmonorops draco, Mart. "Dragon's blood" "Jerenang." Red.
Bixa orellana, L. Arnotto.
Garcinia spp.—Gamboge is not a native of the Malay Peninsula, the pigment being imported into Singapore from Siam. There are, however, many species of Garcinia here which do contain Gamboge, and some of these may produce a good class of the pigment, but as yet they have not been experimented on.

INDIGO.

Indigo is produced by *Indigofera tinctoria*, and *I. anil.* by *Marsdenia tinctoria*, and by the Custard Apple, *Anona squamosa*, and, to a small extent, by various species of *Calanthe*, *Phaius* and a few other orchids. But the only plant from which the dye is extracted here is *Indigofera tinctoria*. *Marsdenia* I have seen growing in some of the indigo fields, and am told that it was introduced by the Malays (probably from Sumatra, though I have met with an allied species wild in Pahang), but that the Chinese, who alone manufacture indigo, do not know how to use it.

Indigofera tinctoria is cultivated to a very large extent in Singapore, and the cultivation seems to be rapidly extending. It is also cultivated in Perak. In Pahang it has been introduced at Pekan and has run wild along the banks of the river near the town, where there is a large quantity. At present it is only cultivated in Singapore for local consumption, but there is so great a demand and it is so easy to grow and to manufacture in the Native method, that it appears to be very remunerative.

The quality of the dye here, however, is remarkably poor, owing to the careless methods in use, so that it would seem that were the Indian method adopted here much larger profits might be made on the plant, and there is no reason why it should not be extensively prepared for export.

The greater portion of the indigo in the home markets is derived from India, and though it would not be possible for the Straits Settlements to compete with India in the matter of quantity turned out, still I think it would be worth while for planters to turn their attention to this plant. The climate of the Peninsula seems to be even better suited for the cultivation than that of India and has some very great advantages. Here, for instance, the plant is grown exclusively from cuttings and not at all from seed as in India. The gain of this is enormous, for whereas in India the seed has to be collected, the ground to be ploughed, rolled and sown, for each crop, here the cuttings once planted require no more labour for six years than manuring after taking the crop. This, it is unnecessary to point out, gives a very large saving in the expenses of labour and apparatus. Again, here the plant can be cropped every four months, whereas in India it takes from five to nine months after planting before the crop can be taken. There being no dry season in the Straits Settlements, the plant is constantly in growth, so that it never dies down and is in fact a perennial. Lastly, the climate is quite free from the prolonged droughts which in India occasionally destroy the whole crop.

Cultivation.

The ground selected is usually open, hilly country such as is used for gambir and in many cases is indeed old gambir ground, but I have also seen the plant cultivated in more low-lying and rather damp ground. Any ground, however, appears to suit it, which is not too dry or excessively wet. The soil is merely dug over with the *changkol*, and finely broken up, all weeds, of course, being taken away.

Cuttings of the stem about six inches long are taken and thrust into the ground five or six together in rows at a distance of about two feet apart and only 1½ or 2 inches are left projecting above soil. They readily take root and grow, and in four months are ready to cut. After being once started the bushes can be cropped three or four times a year for six years without re-planting, but as the plants die fresh cuttings are inserted, so that the field is never bare. Very little if any weeding is required, as the plants grow so closely together that there is no chance for the weeds to come up.

Manuring is done in the following way. After cropping, a trench is dug between every alternate row about a foot deep; in this is laid a small quantity of cow-dung upon which are deposited bundles of the cut plant which have already been used to extract the indigo from, and the trench is then filled in with earth. After the next crop is taken the remaining rows are treated in like manner.

Diseases and Injuries.

The indigo plant appears to suffer but little from disease or injury here. The Director of Land Records and Agriculture of the North-West Province and Oudh (Watt's Dict. Econ. Prod. India) reports:—"Another source of damage to the plant is continued

wet weather which renders it tall and woody without much foliage and by a kind of etiolation prevents the proper development of the dye property in the leaves." Here, however, as the plant is treated as a perennial, and by constant cutting down is prevented from getting drawn up, this rapid growth has no effect on the plant, and apparently heavy rains do it no harm at all. The etiolation referred to I have never seen or heard of here. In wet weather it is true the plant is liable to the attack of a species of aphis which causes the leaves to curl up, but after a few dry days this disappears. Caterpillars of different kinds appear to be rather numerous. One is a green larva (apparently one of the *Tortricidæ*) which spins the leaves together and destroys them. Another is a small hairy *Bombycid* resembling the larva of the English *Liparis auriflua*.

Preparation.

The plants are cut down close to the ground and tied up in bundles about a foot through. Three fair-sized bushes make a bundle weighing about 5 catties. The bundles are then put into a wooden vat about five feet tall and three or four feet across. The vat is filled with water and holds twenty bundles. The plant remains in the water for 24 hours, and is constantly stirred and turned over with a kind of rake composed of a long bamboo handle with a terminal H-shaped piece. The bundles are then taken out and put to drain on a sloping framework over the vat, so that the remaining liquid drains back from them into the vat and more bundles are put in. The used bundles are generally taken back to the fields for manure, but, in some places, they actually re-plant them. The broken bits of leaves and twigs are scooped out with an ordinary shovel basket, and a small quantity of lime water is thrown into the liquid. The lime-water is prepared by pouring water on a lime made of burnt sea-shells, which is made in Singapore. The indigo water is then drawn off from the tubs by spigots into a smaller vat, and more lime-water thrown in. The indigo is allowed to settle for a night, and the clear liquid above drawn off to the level of the precipitated indigo, which is allowed to remain for another day and is then considered ready for sale. The whole process takes about 48 hours.

Dyeing.

The liquid indigo is conveyed to the dyeing house, which is generally near the town, in ordinary wicker baskets lined with a thick layer of Chinese paper through which, as they are borne along, the water drips quite clear, leaving the indigo in the form of a very thick liquid; in this state it is put into the dyeing vats. There is, however, no difficulty in drying off the liquid into a fine powder even by sun heat.

The cloth used most commonly here for dyeing is a common white cloth suited by its cheapness for the clothing of the Chinese coolie, but a better quality is also used for the more aristocratic class. The cloth is first washed and soaked in plain water in large wooden tubs to extract a waxy substance which

interferes with the dyeing, after which it is transferred to a tub of water in which pineapple rinds have been soaked, and then transferred to the indigo vats, which are about six feet tall. Here the cloth remains, being stirred about now and then for various periods according to the depth of colour required, after which it is laid on the grass in the sun to dry.

The black and purple dyes are obtained by the previous use of a solution of Samak bark. Under the name of "Samak" a number of trees producing tan barks are known to the Malays, all of which give a brown colour and are used for tanning nets to prevent their being rotted by sea-water. Of these a common mangrove tree known as Tengah (*Ceriops candolleana*, Roxb.) is used by the Chinese to give the desired blacks and purples to the indigo-dyed cloth. The bark is brought to the dye house in pieces about one foot or a foot and-a-half long and three or four inches wide. By soaking in water a brown extract is produced, in which the cloth is soaked till it becomes of a bright sienna brown. It is then dried on poles or on the grass. When dried, this cloth is dipped in the indigo vats, and dyed with much or little indigo according as purple or black cloth is required.

Sometimes simple Samak dyed cloth is used by the Chinese for wear without colouring with indigo, but it does not give an attractive enough colour.

Calendering.

The Chinese calender or polish the cloth when dry with a large block of granite, broadest at the top where it is somewhat scooped out and with a squared smooth base. The cloth is rolled on a cylinder of wood, and the calenderer stands on the broadest part of the granite block supporting himself by holding to a horizontal bar above his head. In this position by alternately throwing his weight on either of the upper angles of the block he pounds the cloth from side to side on the cylinder of wood beneath the foot of the block, till it is sufficiently polished; when one portion is done, more of the cloth is unrolled from the cylinder and a fresh surface exposed.

The Malays have another method of calendering the silk sarongs made in Singapore. The apparatus consists of a bar of the strong but flexible wood of the Nibong palm (*Oncosperma tigillaria*), which is fixed by one end into a beam in the ceiling of the room, the lower end is inserted into the slit in a large cowry shell. The silk is spread on a wooden table and the operator holding the lower part of the Nibong bar in both hands, rubs it very hard with the shell, the length and springiness of the bar exercising a great pressure upon it. The silk is thus polished bit by bit on both sides. The work is very laborious, and the development of the muscles of the arms and chest of the calenderer is very striking.

Cost and Production of the Indigo.

One square acre of indigo will contain 10,890 plants. Three plants in one cropping will give one bundle of cuttings weighing 5 catties, so that one acre gives 18,150 catties of the cut plant.

Four hundred catties of the crop with 15 catties of lime give 100 catties of liquid indigo, which is valued here at present at one dollar. Partially dried it is valued at $6·50 per pikul. One acre, therefore, gives for each crop 4,537 catties of liquid indigo, value $45·37. This at three crops per year gives a return of $136·11 per acre.

The expenses should be as follows, for one acre:—

2 coolies at . . $6 a month.
Manure . . 25 cart-loads per crop.

I have little doubt but that the outturn could be very largely increased by an improved method of manufacture, as there is not only a great waste of material, but an excessive amount of mineral salts in the indigo as prepared here, which, as it stands, would be of no value for export. I am much indebted to Mr. H. MULLER, F.R.S., for kindly examining a sample of Singapore indigo prepared by drying off the liquid. This done, the result appears as a very light-coloured sample of indigo-cake.

Mr. MULLER writes as follows:—

"The indigo which you sent me differs so widely from any known in commerce that I considered it necessary to have a sufficiently complete chemical analysis made of it, in order to obtain some conclusive evidence as to the cause of its appearance. The analysis gives the following results:—

Moisture		5·15%
Watery extract		2·90%
Organic matter.	Organic matter taken up by dilute hydrochloric acid and dilute caustic alkali	12·75%
Colouring matter.	Indigo blue (*Indigotin*)	7·50%
	Indigo red (*Indirubin*)	1·37%
Mineral.	Sand insoluble in H. Cl.	1·55%
	Oxide of iron	4·56%
	Carbonate of lime	62·45%
	Magnesia	1·77%
		100·00

"We see from these numbers that the amount of *Indigotin* and *Indirubin*, which are the only valuable colouring matter in commercial indigo, is barely 9%, and this, of course, accounts for the very pale colour of your sample, which, for this reason, would probably not find a buyer in the European market. On the other hand, the proportion of mineral matter (70%) is excessive. The true colouring matter contained in your indigo is, of course, perfectly good, and all that is required to render it available for European commerce would be to increase its percentage by reducing that of the mineral constituents as much as possible. There ought to be no difficulty in attaining this object by simply adopting the mode of operation practised in Bengal and Java where some of the best sorts of indigo are produced containing from 60% to 70% of colouring matters. I may remind you that the *Indigo-*

tin and *Indirubin* are formed from a substance contained originally in the juice of the indigo plant, and called indican, in the process of fermentation, and the quantity of colouring matter thus produced entirely depends on the manner in which this process is conducted. If no proper precautions are taken, the indigo produced is partly converted into other substances of no value. I have little doubt that in the rough and ready methods practised by your people a very considerable quantity of the colouring matter is sacrificed."

Defects in the Chinese Method.

There are two serious defects in the Chinese method which injure the product, which could easily be got rid of. One is the careless use of foul or muddy water. The water used is that that is nearest the field, whatever the state of this may be, nor is any attempt made to purify it or to allow the sediment to settle. Muddy water not only spoils the colour of the dye, by filling it with dirt, but it is found that it retards the process of settling. For working on a large scale it would be best to make a reservoir in which the water could be allowed to settle and deposit the organic matter floating in it. Still worse is the overcharging of the liquid with lime to precipitate the indigo speedily and without trouble. The liquid which is obtained by steeping the plant is not indigo-blue, but Indican which has to be decomposed into Indigotin and Indiglucin, and to do this, it appears that it is requisite to oxidise the liquid, and this is done in India by beating it. Men are sent into the tank containing the fluid and beat it with wooden oars or simply with the hand. The higher it is splashed into the air the better, but the beating should not be too violent. Lime-water is added in some cases to precipitate the indigo, but it does not seem to be absolutely necessary, and the less lime there is in the product the better it will be. The Chinese, on the other hand, hardly beat the liquid at all, but precipitate the indigo entirely with lime. Of course this saves a great deal of labour, but at the cost of the dye, of which a large quantity must be wasted. The use of lime, says Dr. Watt, is regarded as destroying the fermentation, which, if still existing in the liquid after preparation, would spoil the product in its later stages of manufacture. If this is so, the excessive use of lime before fermentation is over, prevents much of the indigo-blue being formed. Full accounts of the several Indian methods are to be found in the Dictionary of Economic Products, to which the reader is referred.

Conclusion.

The cultivation of indigo in the Malay Peninsula has certain great advantages over that of India, on account of the constant and steady rainfall, and absence of any dry season. The plant grows easily and well, and there is plenty of suitable land for the purpose. Should an European planter take up the manufacture, it would probably be best for him to purchase as much of the cut plant as he required from the Chinese, who would plant it to any required extent, and could easily be induced to open up extensive plantations even close to Singapore. On receiving the plant he

could manufacture the dye with the aid either of Chinese or, better still, Indian coolies after the Indian methods, and export it to Europe. "Practically nine-tenths of the indigo trade is Indian. It is doubtful how far any country, except perhaps China, could ever compete with India. We possess a complete monopoly, and prices are not governed by competition with other producing countries, but by the caprice of demand or fashion and the uncertainty of the Indian supply. It is generally admitted that few crops are more precarious. Too much or too little rain is equally destructive, and it is impossible to guarantee the quality that can be produced, still less to secure uniformity and continuity of a particular kind from a given factory. It accordingly follows that prices are governed, to a large extent, by internal rather than external circumstances." (WATT.)

OTHER DYE-PLANTS.

Sappan (*Cæsalpinia sappan*, L.) is a tree which is very common in many parts of the Peninsula, both wild and cultivated. The Native name of it is *sepang*, and the wood chips are used, to a certain extent, for dyeing sarongs.

The wood is cut into chips and boiled for from five to eight hours or less, and gives a red dye. The tree grows very readily from seed in almost any soil, but it appears to prefer river-banks and such like damp spots.

Marsdenia tinctoria, Br., is a climber which can be grown readily from cuttings, and in cultivation generally appears as a low shrub. It is probably wild in the Peninsula, but was originally brought from Sumatra. I have seen plants in the Chinese indigo fields, in Singapore, but on enquiry find that the Chinese obtained it from the Malays. In cultivation it requires the same soil and treatment as indigo. The Chinese state that it gives more and better indigo than the *Indigofera*, but at present there is too little in Singapore for it to be regularly utilised.

Noja (*Peristrophe tinctoria*, Nees.).—This, I believe, is the name of an *Acanthaceous* herb very abundant in damp shady spots near villages, but specimens sent to Kew were named *P. montana* var. It is a straggling plant easily reproduced by cuttings, and growing rapidly in open woods. A dye is obtained by boiling the leaves with those of *Melastoma polyanthum*, and a little *Tengah* bark together, in a copper pan for two hours. The proportions are 1 lb. Noja, ½ lb. Melastoma and 2 oz. Tengah. This produces a pink dye, which is said to be stable. A quantity boiled like this gave a very dull red liquid rather thin, and hardly as bright in colour as could be wished, but possibly there was too much *Melastoma*.

Akar Kunyit (*Fibraurea chloroleuca*, Miers) is a strong woody climber, abundant in the woods of the south of the Peninsula and Singapore, from the roots of which a yellow dye can be made. I cannot find that it is now used for this purpose by the Malays.

Henna (*Lawsonia inermis*, L.) "Inai" is only used for dyeing the nails and hair. The leaves are made into a kind of poultice and put on during the night. It gives a red tint to the hair making it of a rather lighter colour. The wild balsams, such as

Impatiens Griffithii, Hook, are said to have the same property and are called "Inai Batu" by the natives.

Tengah bark (*Ceriops candolleana*, Roxb.).—Considerable interest is being taken at present in the extract of mangrove barks for tanning and dyeing purposes, and it is possible that this class of products may eventually find a good demand.

The barks of a number of different mangrove trees are used, as is well known, in the Singapore tanneries in preference to gambir as being cheaper. Of these the most important is Tengah, which is used, as explained above, by the Chinese as a dye as well as a tan-bark.

I took two catties of fresh bark and, having cut it up, soaked it in water for a whole night. Next day it was put into a copper pan and boiled for two hours, being constantly stirred the whole time. The chips were taken out and the liquid boiled till somewhat thick, when it was set to cool and eventually dried off in a shallow pan partially over a slow fire and partly by sun heat. The result was a beautiful crystalline mass of a dark red brown colour of 1¼ lb. weight. It had a strong astringent taste. This was sent to England for report, but none has yet arrived.

Other samples sent from Borneo have given good results, as a dye giving a good red brown colour.

Another bark which may give a valuable product is that of the Nireh (*Carapa moluccana*, Lam.). This has a reputation among the Malays as a medicine for dysentery. It is very common in the mangrove swamps, and it is very conspicuous on account of its large brown cannon-ball like fruit, and the way its bark peels off in thin strips, often forming a pile at the foot of the tree.

Two catties of the bark, boiled in the same way as the Tengah, gave 1 lb. 2 oz. of an extract very similar to that of the latter, but rather less astringent.

Hitherto, though several samples of "Mangrove bark extract" have been sent from East and West Tropics for examination at home, they have not found favour among the tanners and dyers, but at present the product has not had really a fair trial.

In the first place iron pans have been used to boil the bark in, giving a dirty coloured mess full of tannate of iron. Copper pans should always be used for boiling substances containing tannin, especially if they are to be used as dyes.

Again, any or all of the mangrove barks have been used indiscriminately. Now what are commonly known as mangrove trees belong to a large number of different species and even orders of plants, and the quantity and quality of the tannin they contain vary very considerably. Any would-be manufacturer, therefore, who boils all kinds of barks together and hopes to turn out a satisfactory product without knowing what he is boiling, would utterly fail and would thoroughly deserve to. Each kind of bark which contains tannin ought to be tried, but I believe the best of all is the Tengah, which is abundant in Singapore, and easily procurable.

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PATCHOULI.

This plant is one of the minor products of the Malay Peninsula, and the greater part of that imported into Europe comes from the Malay Peninsula or the neighbouring islands, and as planters are often anxious to take up a plant which gives a good profit in return for a little trouble, it may be as well to put together some notes concerning it.

The Plant (Pogostemon patchouli).

The commonly cultivated form never seems during cultivation to produce flowers. It is a soft-leaved herb from one to two feet high, much branched, with square stems, emitting, when rubbed, the characteristic smell of Patchouli. It has been stated that the wild form is scentless, and that plants raised from seed are also scentless. This latter fact may be the case, but I am not aware of any one ever having seen the seed.

Although it is stated in the Kew Bulletin (1888, p. 73) that the true Patchouli plant is free from ambiguity, this can only apply to the cultivated and flowerless form as several plants apparently quite distinct have been figured or described as being the true wild Patchouli.

I have met with a flowering species of *Pogostemon* in the Straits Settlements which possesses the true scent and which appears to be either the original plant or the cultivated Patchouli run wild. The plant is known to the Natives as "Poko Nijao," "Rumput Kuku," "Poko Nilam Bukit," and "Chilam Bukit." "Nilam" is the Native name for Patchouli, and the addition of Bukit implies that it is a wild form. I have collected it in Pahang at Pulau Tawar, and far up the Tahan River, and at Kota Tinggi in Johor. There are also specimens in the Botanic Gardens Herbarium from Bukit Sulu and Temiyiang in Sungei Ujong. What appears to be the same plant collected in Borneo at Pengkulu Ampat, by Dr. Haviland, is described as having a blue corolla instead of a white one.

In all the places where I have seen this plant, there are traces of cultivation or it has been near cultivated grounds. The localities were damp spots on the banks of rivers or streams. I also found in a Chinese garden in Singapore, a flowering *Pogostemon* with Patchouli scent which was probably Patchouli in a flowering state. It differs in some respects from the Pahang and Johor plant, but that may be due to its growing in a hotter and drier spot.

This was a branching herb with purplish stems, leaves long petioled ovate to ovate, lanceolate crenate green above and purple beneath, 1 to 3 inches across. The flowers are very small arranged in whorls in a terminal spike. Bracts lanceolate acute. The calyx is very hairy, with acute lanceolate sepals. Corolla little longer than the calyx, the lobes oblong lanceolate blunt recurved, white pubescent outside, tinted with rose-colour in the mouth. Stamens erect, projecting far out of the corolla, tube white with the filaments strongly bearded. Style longer than

the stamens, erect bifid with rather long acute arms. The Pahang form is much slenderer and more drawn up with rather a long terminal spike of whorls.

Dr. PRAIN, in a letter, says that this is near *P. parviflorum* and *P. Heyneanum*. It is a very different plant from that figured in WIGHT's Icones 1440 as *P. Heyneanum* which is referred to *P. patchouli* by HOOKER (Flora of British India, Vol. IV, 634), both in its much less branched inflorescence and its very much shorter corolla. PELLETIER's figure (Mem. Soc. Orl., v. 5), and that of Sir WILLIAM HOOKER in the Kew Journal, I, 328, t. 11, I have not been able to compare with this plant.

I have doubts as to its being native of the Malay Peninsula, as Mr. WRAY says, in an article published in the Agricultural and Horticultural Society of India, "the wild tribes are very fond of it and carry it far into the jungles." It was with *Caladium antiquorum* and *Justicia Gendarusa* that I found it, far away in the Tahan woods, two cultivated plants neither of which are native of this region. The common name "Nilam" means also a sapphire, and as "Nila" means blue, it probably refers to the bluish colour of the inflorescence. "Kuku" may be an error for "Ruku" (*Ocymum basilicum*) with which it may have been confused.

CULTIVATION.

The Chinese, who chiefly cultivate this plant, often plant it on newly cleared ground among the fallen logs. Here slightly shaded it seems to grow very rapidly and well. But in most places where it is regularly cultivated, it is planted in properly prepared beds. The best method of propagating is by cuttings of young shoots. These are cut about 3 inches long, care being taken to cut just below a joint. The cuttings are then pricked into nursery beds well watered and shaded. In from three weeks to a month they will have rooted and can be removed to the permanent beds, where they should be shaded till thoroughly established. The plant grows very well in open sun, but it will also stand a little shading without any great injury, and it may be planted beneath coffee or other trees. Though it will grow in most places, a loose sandy mould is the soil that suits it best, and the position should be low-lying and fairly dry.

The cuttings should be planted on slightly raised ridges about a foot apart in rows, with about two feet between each row.

One-twentieth of an acre planted by Mr. CURTIS in February was cut in July 21st and gave 449 lbs. of green stuff, after ten days it had dried to 106 lbs., which, on picking over, gave 69 lbs. good leaf and 37 lbs. refuse. The same patch was cut again in January and gave approximately the same result, so that one acre produces more than a ton of good leaf per year which may be valued as from £100 to £115.

CROPPING.

The first crop can be cut six months after planting and afterwards twice a year. It is usual in Perak, according to Mr. WRAY,

to take only three crops and then re-plant, and as the plant is so easy to grow and of such rapid growth, this is probably the best method to pursue.

The leaves when cut may be dried in the sun, but it is better to dry them in shade, spreading them out on the ground in a cool airy shed; in this way they take about a week to dry. When quite dry, they can be packed in bales, they should not be allowed to get brittle but remain fairly flexible.

As the stalks do not contain any oil, the fewer there are in the sample the better, but the ordinary quality contains a large percentage of useless stalks.

Adulterations.

The Natives use the leaves of a common weed "Pulut Pulut" or "Perpulut" (*Urena lobata*) for adulterating the Patchouli. It has no scent nor apparently any properties of value. Another plant used for the same purpose is "Ruku Ruku" (*Ocimum basilicum*), a strongly scented labiate herb, often grown in villages and half wild in waste spots. It is used as a medicine by the Malays.

Manufacture of the Oil or Attar.

Buyers, says Mr. Treatt, would prefer to buy the oil itself, but, as a rule, distillers in the East adulterate it. Mr. Wray gives the following account of its manufacture:—"The dried Patchouli is put into a copper cylinder fitted with a perforated false bottom and mounted on trunnions. Through one of these steam enters from a boiler and is conducted by a tube beneath the false bottom. The remaining trunnion is also hollow and the steam, after passing through the leaves, passes out by it and into a worm immersed in a tube of water in the ordinary way. The pressure of steam employed is about 10 lbs. per square inch, but it varies with the size of the worm and the temperature of the water used to cool it. One pikul of the dried Patchouli just as it is cut yields from 24 to 30 ounces of essential oil, and a sample free from the heavier stalks yields about double that amount." "Thirty-six pounds of green leaves produce 10 lbs. of Patchouli."

Prices.

The value of the product is liable to great variation, not only according to the quality of the sample, but also according to the quantity thrown into the market at one time. For as the demand is small compared with the amount which could be supplied at a comparatively short notice, the price fetched naturally fluctuates considerably. Of samples cultivated and prepared by Mr. Curtis in Penang and sent to Piesse and Lubin for report in 1887, the latter gentlemen say (Kew Bulletin, 1888, p. 71):—"The sample No. 1 is excellent. The commercial value we estimate to be about £80 or £100 per ton.* * * * * The demand for both leaves and attar of Patchouli, though not very great, is steady and continuous. The attar fetches 2/6 to 3/ per oz. weight."

Mr. TREATT says:—"The leaves fetch, if good, 1/ to 1/3 per lb., less 2½ per cent., and if a genuine oil could be shipped, it would fetch 3/ to 3/6 to 3/9 per oz."

These prices appear to hold good so long as an excessive quantity is not thrown on the market. This being the case, it is obvious that any very extensive cultivation of the plant would eventually cease to pay, but as a temporary crop to cover expenses while planting permanent crops, it is well worth the attention of planters on account of the ease and rapidity with which it grows and the simple method by which it can be prepared.

REFERENCES.

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NGAI CAMPHOR.

There are three very different plants which produce Camphor—*Cinnamomum camphora*, L., the Formosan Camphor; *Dryobalnops aromatica*, Gaertn., Borneo Camphor; Kapur Barus and *Blumea balsamifera*, Decand., the Ngai Camphor. The first two are trees, the third a tall herb. The Formosan Camphor is tolerably easily grown in Singapore, but is rather slow of growth and would not pay to cultivate as long at least as the Camphor forests of Formosa, Japan and China last. The Borneo Camphor tree is of still slower growth and would still less be of value for cultivation. The Borneo Camphor, however, is very much prized, and is too expensive to find its way into European trade. Ngai Camphor has a value intermediate between that of the two others. It is about ten times the price of Formosan Camphor and never finds its way to Europe as a trade article. It is manufactured in Canton and at Hainan and used in China in medicine and for perfuming Indian ink. The plant which produces it (*Blumea balsamifera*, Decand.) is an exceedingly common weed over most of the open country of the Peninsula. It attains a height of about ten feet, with a stout almost woody stem and soft pubescent leaves, which vary in shape from runcinate to almost entire ovate lanceolate. The flowers are in small heads orange yellow.

Blumea will grow apparently wherever the soil is not too wet for it, and, like all such plants, is of rapid growth. I have seen thickets of the plant of considerable extent in the Dindings, and

there is no doubt that it could be cultivated to any extent. I have been unable to get any information as to the method of treatment by the Chinese, by which the Camphor is extracted, but having procured a quantity of the leaves, I submitted them to distillation by steam in much the same way as is described above for Patchouli. The fresh leaves and stalks (which also contain Camphor) were put in a pan perforated below, in a copper still, water was put in the lower part of the cylinder of the still and heated. The steam passed through the leaves into a worm cooled in water. By this method a quantity of a clear-bright green oil was produced with a strong camphoraceous odour.

As the leaves retain their aromatic scent after drying, it may perhaps be better to dry them first in the shade before extracting the Camphor, and in collecting the wild plant this would be of advantage inasmuch as Natives in many places could collect and dry the leaves and bring them down to the stills much more conveniently on account of the diminution in bulk of the dry material. The plant being so abundant here and the product so valuable, it seems well worth trying whether this Camphor could not be manufactured with profit.

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PINEAPPLE FIBRES.

The pineapple is cultivated very extensively in many parts of the Peninsula, but especially in Singapore for local consumption and also for tinning. Lately in Singapore the supply has been so increased that prices have fallen very considerably; still, however, more land is being taken up for its cultivation. Hitherto, however, little has been done with the fibre of the leaves,, which is one of the finest and strongest fibres in the world. It is equally good as a textile or as a rope fibre, "surpassing in strength, fineness and lustre the fibres of flax." In the Philippine Islands an extremely fine muslin called Pina is made of it, and another fabric is made of it in combination with Manila hemp. In Singapore it was prepared many years ago by the Chinese for export to China for manufacture of cloth, and sarongs of it are still made by the Bugis at Pasir Panjang in Singapore.

As a twine or rope fibre it has great strength, and a certain quantity made at Madras by Dr. Royle bore a strain of 260lbs. and a similar quantity made in Singapore bore 350lbs., while New Zealand flax bore 260lbs.

The fibre is rather troublesome to prepare owing to the hardness of the epidermis, and perhaps this had had something to do with the neglect of the manufacture. But the great demand for

pines for tinning has turned the attention of cultivators rather in this direction as being an easier and more remunerative work.

Cultivation of Pines for Fibre.

The pine as grown for its fruit in open country has leaves too short to be of any value for fibre. But if these plants are allowed to grow among grass and brushwood they produce no fruit, but the leaves attain a length of from six to eight feet and are suitable for the preparation of the fibre. The cuttings should be planted about five feet apart, in fairly dense brushwood, about 15 or 20 feet high. The poorness of the soil is immaterial, and no manuring appears to be necessary.

Mr. Derry, who has been experimenting with plants found on an old tapioca estate at Machap in Malacca, estimates that in full bearing 12 cwt. of fibre may be obtained from an acre per year.

Preparation.

The simplest method of extracting the fibre is by macerating for 8 days in water and rubbing away the parenchymatous tissue when the leaf is sufficiently softened. This soaking, however, discolours the fibre and probably weakens it. A better plan, though more laborious, is to scrape the leaf with a piece of pottery or a knife, or by the following method: the leaf is laid on a board and the epidermis removed with a knife. The fibres can then be easily detached with a broad bladed knife and pulled out.

Samples prepared by maceration and by scraping were forwarded to Messrs. Ide & Christy for their report, which is as follows:—

"No. 1.—*Pineapple fibre obtained by scraping the leaf.*—This is well cleaned, but we think that possibly an even better colour might be obtained. Pineapple fibres have never been imported into England in sufficiently large quantities to test their full capabilities and value. Such parcels as have come into the market, rarely exceeding a few bales at a time, have generally only found purchasers among the rope and cord makers, and for such ordinary purposes we value your sample at £24 a ton to-day in London. We are of opinion, however, that the fibre is fit for much better purposes than this, and if parcels of 5 to 10 tons were prepared and sent home, an adequate test of its real value might be found.

"No. 2.—*Prepared by maceration.*—This is not so well done as the other, neither is it so long, while its somewhat dirty colour is against it to the extent of £5 per ton."

Another firm writes: "This fibre in large quantities would easily sell for £40 a ton; there is a very large demand for it."

This report appears to be very satisfactory, the price offered for the best sample being as high as for Manila hemp. But for the Chinese market the price offered is very much higher. Mr. Derry writes: "I am informed pineapple linen (called by Hokkiens Ki Sang Pé) is manufactured as largely as possible in China and is much valued. A piece of the linen sufficient for five Chinese jackets is said to be worth $22 in Singapore. Two Malays

at Bukit Bruang (Malacca) prepare the fibre at times and sell it to a Chinese trader at the rate of $15 a pikul. A sample I had prepared from long leaves was valued by Chinese firms in Singapore at $30 a pikul."

FOREMAN in his work on the Philippines puts $8·50 per pikul as the price of first quality Manila hemp. But it must be remembered that this latter is only used for rope and twine, and Messrs. IDE & CHRISTY's estimates of the value of the pineapple fibre above quoted were for the rope trade. If it is possible to get better class pine fibres accepted for the making of "linens" or muslins, the price will naturally be much higher.

For this it will be essential to get the fibre as clean and white as possible, and it would be necessary to extract it by the scraping process and not by the easier macerating one. Bleaching is said to destroy the adhesion between the bundles of fibres and renders them fit to be spun in the same way as flax.

There are many places in the Straits Settlements where pines could readily be grown for fibre; especially suitable are the waste spots round the villages where bushes and grass have been allowed to grow up and, furthermore, there are very many such spots where already the pines are growing, having originally been planted for food and afterwards abandoned. From these spots leaves seven or eight feet long could readily be obtained, and were any encouragement given to the Natives, by the purchase of these leaves, they would collect and bring them to a factory in large quantities, and by these means a trade of considerable value might be opened up.

The work might be lightened by the use of machinery, but at present no very satisfactory cleaning machine for pineapple fibre has been invented. DEATH's machine as used for Mauritius hemp (*Fourcroya*) seems to be the most suitable, but I can hardly recommend it.

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FIBRES FOR BRUSHES.

The brush-makers report that fibres suitable for making brushes are just now very much wanted. Hitherto the fibres of Piassava (*Attalea funifera*), a South American palm, have been the source of the supply, but the amount which can be now procured is very far short of the demand.

Bassine (*Borassus flabelliformis*) is another fibre which has been adopted, but of this, too, the supply is limited. The fibres of the Kittul (*Caryota urens*, L.) have been found satisfactory, but are not to be procured in any large quantity. Mr. BULKELEY, who was recently visiting Singapore in search of suitable fibres

for this purpose, considered that the medium-sized fibres of the sugar palm, Kabong (*Arenga saccharifera*) would be the most suitable. The class of fibre required is one at least nine inches in length, fairly stiff but not brittle, and unaltered by steam or hot water, as the brushes are chiefly required for cleaning boilers and such like work. The Kabong palm produces fibres of various thicknesses from its leaf sheath. The thickest ones are too brittle to be of any value whatever. The very thin ones, such as are used for the black cord called "Tali Hijau," are too thin and not sufficiently stiff, but those of intermediate size will probably be found to be suitable for the desired article. At the present time from five to ten thousand tons of brush fibres could be readily sold in the home markets. Attention is called to this important industry, as there may be other plants in the Malay Peninsula which will be found to produce this much desired article.

WILD PLANTAIN FIBRE.

In many parts of the forest country of the centre of the Malay Peninsula wild plantains are very abundant. In Perak I have seen hill-sides, especially after the fall of the big jungle, covered with great quantities of one species of wild plantain, apparently *Musa sumatrana*. At present this plant is destroyed as worthless when clearing for coffee planting, but it appears to contain a fibre which, if not equal to that of the Manila hemp (*Musa textilis*), would probably pay to manufacture.

There are three wild species of *Musa* known to me in the Peninsula, two of which are in many places abundant. Of these, at present, experiments have only been made with the Pisang Karok of the Malays, which I take to be the *Musa sumatrana* of Miquel.

Mr. DERRY reports it as common at elevations of 200 feet from Bukit Panchor in Malacca to the frontier. I have also seen it in Sungei Ujong, Selangor, Pahang and on the slopes of the Hermitage Hill, and around the Waterloo Estate in Perak.

To cultivate it in these localities nothing further is required than to clear the land on which it grows as it then very rapidly springs up replacing the fallen timber. It also grows rapidly from seed or suckers and thrives in any spot which is neither too dry nor excessively wet. It appears in fact to require the treatment of the common cultivated Banana.

A quantity of fibre was prepared by Mr. DERRY simply by hand, and it was forwarded to Messrs. IDE & CHRISTY for report. They write as follows: "We regret that this is much too hard and coarse to be of any use, and in its present state would be quite unsaleable. Were it better prepared so that the fibrous filaments were free as in Manila hemps, it might command the same price, but we think the fibre very much weaker than that prepared from *Musa textilis*."

This latter fibre plant has been more or less tried in India, and certainly seems to grow well enough here, but has not given satis-

factory results, probably as Mr. FOREMAN (Philippine Islands, p. 327) suggests from improper preparation.

It is probable that better results will be obtained with our wild plantain if the Manila method of extraction is adopted,. The following is excerpted from the above-mentioned books:—

"The hemp fibre is extracted from these petroles which, when cut down, are separated into strips five or six inches wide and drawn under a knife attached at one end by a hinge to a block of wood. The bow tends to raise the knife, and a cord attached to the same end of the knife and a treadle is so arranged that by a movement of the foot the operator can bring the knife to work on the hemp petiole with the pressure he chooses. The bast is drawn through between the knife and the block, the operator twisting the fibre at each pull around a stick of wood, while the parenchymatous tissue remains on the other side of the knife. The knife should be without teeth or indentations, but nearly everywhere in Capis Province I have seen it with a slightly serrated edge. The fibre is then spread out to dry, and afterwards tightly packed in bales with iron or rattan hoops for shipment."

"Many attempts have been made to draw the fibre by machinery, but apparently all have been unsatisfactory. Care is to be taken not to bruise the stem as that would weaken and discolour the fibre. It is usually planted from six months old suckers and then requires three years to arrive at maturity, and a year longer if to be raised from seed. The suckers are planted thirty-six Spanish square feet apart. The stem is cut at the flowering maturity. The outer sheaths are not used nor the slender central stem."